
C.DC

Part 1: Vaccine-Preventable Diseases and Childhood Vaccines

Diseases

Here are the 14 diseases that can be prevented with routine childhood vaccination, and a brief description of each disease:

- Diphtheria
- Hepatitis A
- Hepatitis B
- Hib
- Influenza (flu)
- Measles
- Mumps
- Pertussis (whooping cough)
- Pneumococcal disease
- Polio
- Rotavirus
- Rubella
- Tetanus
- Varicella (chickenpox)

Diphtheria

Diphtheria is caused by bacteria that live in the mouth and throat of an infected person and cause a sore throat, fever and chills. If diphtheria is not properly diagnosed and treated, the bacteria can produce a toxin that causes serious complications such as heart failure and paralysis. About one person in 10 who get diphtheria dies from it. Diphtheria used to be a major cause of childhood illness and death. It is spread from person to person through sneezing, coughing, or even breathing. Through the 1920s about 150,000 people a year got diphtheria, and about 15,000 of them died.

Hepatitis A

Hepatitis A virus causes liver disease, which can result in fever, loss of appetite, fatigue, stomach pain, vomiting, and yellow skin or eyes (jaundice). Children younger than about 6 years old might not show any symptoms. About 100 people die each year from liver failure caused by hepatitis A. Hepatitis A virus is found mainly in bowel movements, and is spread by personal contact or through contaminated food or water.

Hepatitis B

Hepatitis B virus also causes liver disease (the word hepatitis comes from the Greek words for "liver" and "inflammation"). It is spread through contact with blood and other body fluids. Hepatitis B infection can cause muscle or stomach pains, diarrhea or vomiting, yellow skin or eyes (jaundice) or loss of appetite and fatigue. People usually recover after several weeks, but some of them become "chronically infected." These people can spread the disease to others through unprotected sex, sharing needles, or other exposures to blood. Chronically infected people often suffer from cirrhosis (scarring of the liver) or liver cancer, and about 3,000 to 5,000 die each year. Health care workers are at increased risk, as are police officers and other public service workers. A mother who is chronically infected with hepatitis B virus is very likely to infect her baby at birth. Other than babies of infected mothers, children aren't at particularly high risk. But vaccinating children is a practical way to insure that they will be protected later in life when they could be at risk. Rates of hepatitis B have dropped significantly since we began vaccinating children in 1991.

Haemophilus influenzae type b (Hib)

Before there was a vaccine for it, Hib disease was the leading cause of bacterial meningitis in children younger than 5. As recently as the mid-1980's it struck one child out of every 200 in that age group. About 1 in 4 of these children suffered permanent brain damage, and about 1 in 20 died. Hib bacteria are spread through the air by coughing, sneezing and breathing. If they enter the bloodstream, they can cause meningitis, pneumonia, inflammation of the throat, arthritis, and other problems.

Influenza (Flu)

Flu is a seasonal illness, occurring mainly during the winter. It causes fever, sore throat, cough, headache, chills and muscle aches, and can lead to sinus infections, pneumonia, inflammation of the heart, and death. Flu causes more deaths each year than any other vaccine-preventable disease. Most of these deaths are among the elderly, but flu also kills children. Hospitalization rates are high among children, especially those under 1 year old.

Measles

Measles virus causes a rash all over the body, fever, runny nose and cough. About 1 child in 10 also gets an ear infection, up to 1 in 20 gets pneumonia, 1 in 1,000 gets encephalitis, and 1 or 2 in 1,000 die. Before there was a vaccine nearly every child in the United States got measles by age 15. About 450 died each year, 48,000 were hospitalized, 7,000 had seizures, and about 1,000 suffered permanent brain damage. Measles still kills about a half million people a year around the world. Measles is extremely contagious, and is spread through the air by coughing, sneezing, and even breathing.

Vaccine Trivia:

The word "measles" probably comes from a Latin word meaning "miserable."

In 1970, astronaut Ken Mattingly could not participate in the Apollo XIII moon mission because he had been exposed to measles.

Mumps

Mumps is a relatively mild disease, causing swelling of the cheeks and jaw due to inflammation of the salivary glands, fever and headache. It can lead to meningitis in about 1 child in 10, and occasionally to encephalitis or deafness (about 1 in 20,000) or death (about 1 in 10,000). It is spread from person to person through the air. It used to be a very common childhood disease.

Pertussis (Whooping Cough)

Pertussis is caused by a bacteria. It can look like a common cold at first, but after 1 or 2 weeks a child with pertussis is overcome with coughing spells so violent that they interfere with eating, drinking, and even breathing. Pertussis can lead to pneumonia, seizures,

encephalopathy (brain infection), and death. Like most childhood vaccine-preventable diseases, pertussis is spread through the air from person to person. Pertussis rates have been increasing in recent years, with more than half of cases among children who are not completely immunized.

Pneumococcal Disease

After Hib disease began to decline, thanks to Hib vaccine, pneumococcal disease became the most common cause of bacterial meningitis in children under 5. Caused by a bacteria and spread through the air, pneumococcal disease also causes ear infections, blood infections, and death. It is most common in winter and early spring. Some groups, including African Americans, some Native American tribes, children with sickle cell disease or HIV infection, and children without a functioning spleen, are at increased risk for pneumococcal disease.

Polio

Anyone old enough to remember the 1950s will remember the panic caused by polio – a virus that left up to 20,000 people paralyzed each year, unable to walk or sometimes even to breathe. About 1,200 people in the United States were permanently confined to 700-pound "iron lungs" to enable them to breathe, and about 20 of these polio victims still live in them today. Thanks to polio vaccine, there has not been a case of polio in the United States in years.

Vaccine Trivia:

The "March of Dimes" began in 1938 as a fund-raising campaign for polio. People were asked to mail one dime directly to the White House to help fight the disease. In the first 3 days, the White House received 230,000 dimes. President Franklin D. Roosevelt, whose profile appears on the dime, was himself paralyzed by polio.

Rotavirus

Rotavirus causes gastroenteritis (diarrhea and vomiting) in young children. Before vaccines, rotavirus infection was responsible for more than 400,000 physician visits, 200,000 emergency department visits, up to 70,000 hospitalizations, and 20 to 60 deaths a year, and cost about a billion dollars a year in time lost from work to care for sick children.

Rubella (German Measles)

Rubella is generally a mild disease, caused by the rubella virus. It causes swollen glands in the back of the neck, a slight fever, rash on the face and neck, and sometimes arthritis-like symptoms in the joints. It is usually spread through the air. However, the greatest danger from rubella is to unborn babies. If a woman gets rubella early in her pregnancy, there is an 80% chance her baby will be born deaf or blind, with a damaged heart or small brain, or mentally impaired. This is called Congenital Rubella Syndrome, or CRS. Miscarriages are also common among women who are infected with rubella during pregnancy. In 1964-65, before there was a vaccine, a major rubella epidemic in the United States infected 12.5 million people and led to 20,000 cases of CRS.

Tetanus (Lockjaw)

Tetanus is different from other vaccine-preventable diseases in that it does not spread from person to person. Children (and adults) become infected when the bacteria enter through breaks in the skin – usually cuts or puncture wounds. About 3 weeks after exposure, a child might get a headache, become cranky, and have spasms in the jaw muscles. The bacteria can then produce a toxin that spreads through the body causing painful muscle cramps in the neck, arms, legs, and stomach. These can be strong enough to break a child's bones, and a child might have to spend several weeks in the hospital under intensive care. About 2 people out 10 who develop tetanus die.

Varicella (Chickenpox)

Before vaccine, almost every child in the United States (about 4 million each year) got chickenpox. The main symptom of chickenpox is an itchy rash all over the body, usually along with fever and drowsiness. It spreads from person to person through the air, or through contact with fluid from the rash. Chickenpox is usually mild, but it can cause skin infections and encephalitis. Among infants less than a year old who get chickenpox, about 4 in 100,000 die. A pregnant woman who gets chickenpox around the time of delivery can infect her baby, and about 1 in 3 of these babies will die if not treated quickly. After a person recovers from chickenpox, the virus stays in the body and can re-emerge years later to cause a painful condition called shingles.

Notice that a common theme in these descriptions is how harmful or prevalent these diseases used to be. Today, a pediatrician might practice for many years and never see a single case of measles, or pertussis, or Hib. Why? Because most parents make sure their children are vaccinated against childhood diseases, and this has resulted in a dramatic decline in disease.

"Where have the kids gone?"

- Emergency Room doctor in Los Angeles commenting on how few patients are admitted for pneumococcal meningitis and rotavirus gastroenteritis since the vaccines became widely used.

Here are some examples of how much disease levels declined since vaccination began.

Disease	Annual Number of Reported Cases: Pre-Vaccine	Number of Reported Cases: 2007	Percent Decline
Diphtheria	175,885	0	100%
Tetanus	1,314	28	98%
Measles	503,282	43	99.9%
Mumps	152,209	800	99.5%
Rubella	47,745	12	99.9%
Congenital Rubella Syndrome	823	0	100%

The "pre-vaccine" figures are averages of reported cases, representing yearly incidence during the years just prior to the availability of a vaccine.

Vaccines

There are ten routine childhood vaccines that protect children from these 14 diseases:

DTaP: Protects against Diphtheria, Tetanus & Pertussis
MMR: Protects against Measles, Mumps & Rubella
HepA: Protects against Hepatitis A
HepB: Protects against Hepatitis B
Hib: Protects against *Haemophilus influenzae* type b
Flu: Protects against Influenza
PCV13: Protects against Pneumococcal disease
Polio: Protects against Polio
RV: Protects against Rotavirus
Varicella: Protects against Chickenpox

(Some bacteria or viruses – for example, pneumococcal, rotavirus, and influenza – have many strains, and existing vaccines protect only against selected strains . . . generally the most common or those most likely to cause illness in children.)

All of these vaccines are injections (shots), except for rotavirus, which is given orally, and one type of influenza vaccine, which is sprayed into the nose.

The Vaccine Schedule

All childhood vaccines are given as a series of 2 or more doses. The childhood vaccine schedule shows the recommended ages at which each vaccine dose should be given.

Here is the routine childhood schedule. For a more detailed and comprehensive version of this schedule, you can visit the CDC website at: **http://www.cdc.gov/vaccines/recs/schedules/default.htm#child**.

- For some of these vaccines, a booster dose at 4-6 years is also recommended.

- Influenza (flu) vaccine is recommended every winter for children 6 months of age and older.

 at birth	HepB
 2 months	HepB (1-2 mos) + DTaP + PCV13 + Hib + Polio + RV
 4 months	DTaP + PCV13 + Hib + Polio + RV
 6 months	HepB (6-18 mos) + DTaP + PCV13 + Hib + Polio (6-18 mos) + RV
 12 Months	MMR (12-15 mos) + PCV13 (12-15 mos) + Hib (12-15 mos) + Varicella (12-15 mos) + HepA (12-23 mos)
 15 months	DTaP (15-18 mos)

Flexibility in the Vaccine Schedule

Vaccine doses are recommended at specific ages. These recommendations are based on studies showing when children are at highest risk for the different diseases and at what ages vaccines work best. But the schedule is not "one size fits all," as it has been described by some people. It can be modified in several ways:

1. Notice that some of the doses on the above schedule may be given over a *range* of ages. For example, the 6-month dose of Polio vaccine can actually be given anywhere between 6 and 18 months without making it less effective.

2. A number of "combination" vaccines are also available. Combination vaccines contain several vaccines in a single injection. Combination vaccines include:
   - DTaP-Polio-Hepatitis B (also called Pediarix®)
   - DTaP-Hib (also called TriHIBit®)
   - DTaP-Polio-Hib (also called Pentacel®)
   - DTaP-Polio (also called Kinrix®)
   - Hib-Hepatitis B (also called Comvax®)
   - MMR-Varicella (also called MMRV or Proquad®)

3. Finally, for every vaccine there are "contraindications" and "precautions." These are conditions that make a child ineligible to get certain vaccines, or cause vaccine doses to be postponed. For example, a child who has a severe allergy to eggs should not get flu vaccine (which contains egg protein); or a child with a weakened immune system should not get live-virus vaccines. A child who is moderately or seriously ill should usually wait until he recovers before getting any vaccine.

You can talk with your doctor or nurse about using combination vaccines and taking advantage of the age ranges for certain vaccine doses to customize your baby's personal immunization schedule, reducing the number of shots she gets at a given visit. They will also help you determine if any contraindications or precautions apply to your baby.

Other Vaccines

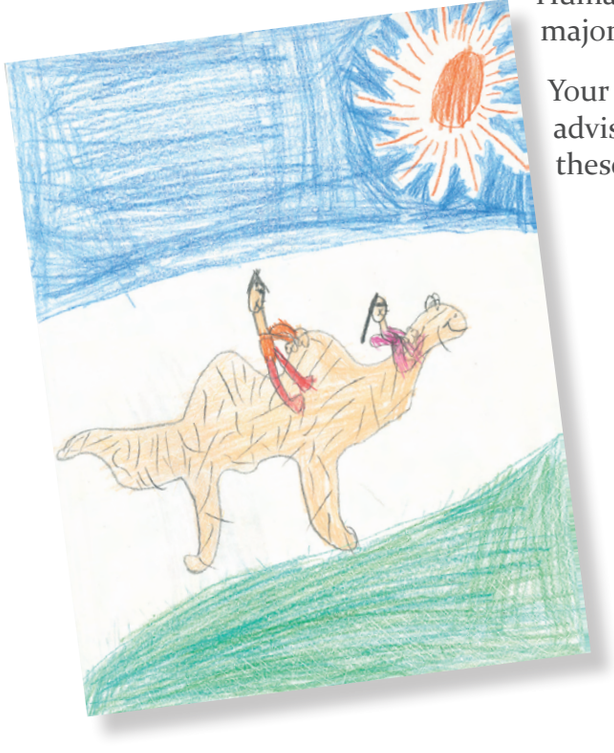
In addition to these routine childhood vaccines, there are other vaccines that are recommended for older children or adolescents, or for young children under certain circumstances.

Rabies vaccine might be recommended for children bitten by animals, or for children living or traveling in a country where rabies is common.

Children traveling abroad may need other vaccines too, depending on the countries they are visiting. These vaccines could include Japanese encephalitis, Typhoid, Meningococcal, or Yellow fever.

Meningococcal vaccine is recommended for adolescents between 11 and 18 years of age to protect them from an infection that can cause bacterial meningitis. Tdap, a vaccine similar to DTaP, only formulated for adolescents and adults, is recommended at the 11-12 year doctor's visit. Human papillomavirus (HPV) vaccine is recommended for girls at 11-12 years of age, and may be given to boys at that age as well. Human papillomavirus is a major cause of cervical cancer.

Your health-care provider can advise you about the use of these vaccines.



Vaccine Trivia:

The world's first vaccine, Dr. Edward Jenner's smallpox vaccine, was actually made from *cowpox* virus. Jenner called the process "vaccination" from *vacca*, a Latin word for cow.

Smallpox is the first, and so far the only, disease completely eradicated from the planet, thanks to vaccination. The last case of smallpox on Earth was in 1977.